Chapter 1

Functions and Graphs Review

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- Function
- Vertical Line Test
- One-to-one
- Horizontal Line Test
- Domain
- Range
- Inverse function
- Restricting a domain to make a one-to-one function

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- Composite functions

- Degree, y-intercept, zeros for a polynomial function

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- Trigonometric functions and identities
- Solving trigonometric equations
- Solving logarithmic equations

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For the following problems, consider a restaurant owner who wants to sell T-shirts advertising his brand. He recalls that there is a fixed cost and variable cost, although he does not remember the values. He does know that the T-shirt printing company charges $440 for 20 shirts and $1000 for 100 shirts.

331. a. Find the equation $C = f(x)$ that describes the total cost as a function of number of shirts and b. determine how many shirts he must sell to break even if he sells the shirts for $10 each.

332. a. Find the inverse function $x = f^{-1}(C)$ and describe the meaning of this function. b. Determine how many shirts the owner can buy if he has $8000 to spend.

For the following problems, consider the population of Ocean City, New Jersey, which is cyclical by season.

333. The population can be modeled by $P(t) = 82.5 - 67.5\cos\left[(\pi/6)t\right]$, where t is time in months ($t = 0$ represents January 1) and P is population (in thousands). During a year, in what intervals is the population less than 20,000? During what intervals is the population more than 140,000?

334. In reality, the overall population is most likely increasing or decreasing throughout each year. Let's reformulate the model as $P(t) = 82.5 - 67.5\cos\left[(\pi/6)t\right] + t$, where t is time in months ($t = 0$ represents January 1) and P is population (in thousands). When is the first time the population reaches 200,000?

For the following problems, consider radioactive dating. A human skeleton is found in an archeological dig. Carbon dating is implemented to determine how old the skeleton is by using the equation $y = e^{rt}$, where y is the ratio of radiocarbon still present in the material, t is the number of years passed, and $r = -0.0001210$ is the decay rate of radiocarbon.

335. If the skeleton is expected to be 2000 years old, what percentage of radiocarbon should be present?

336. Find the inverse of the carbon-dating equation. What does it mean? If there is 25% radiocarbon, how old is the skeleton?

Hyperbolic Functions

DEFINITION

Hyperbolic cosine

$$\cosh x = \frac{e^x + e^{-x}}{2}$$

Hyperbolic sine

$$\sinh x = \frac{e^x - e^{-x}}{2}$$

Hyperbolic tangent

$$\tanh x = \frac{\sinh x}{\cosh x} = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

Hyperbolic cosecant

$$\operatorname{csch} x = \frac{1}{\sinh x} = \frac{2}{e^x - e^{-x}}$$

Hyperbolic secant

$$\operatorname{sech} x = \frac{1}{\cosh x} = \frac{2}{e^x + e^{-x}}$$

Hyperbolic cotangent

$$\coth x = \frac{\cosh x}{\sinh x} = \frac{e^x + e^{-x}}{e^x - e^{-x}}$$

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